

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
2 June 2005 (02.06.2005)

PCT

(10) International Publication Number  
**WO 2005/050022 A1**

(51) International Patent Classification<sup>7</sup>: **F04B 53/12**

(21) International Application Number:  
PCT/US2004/038130

(22) International Filing Date:  
15 November 2004 (15.11.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/519,887 14 November 2003 (14.11.2003) US

(71) Applicant (for all designated States except US): **APPRO  
TEC USA** [US/US]; 2435 Polk Street, San Francisco, CA  
94109 (US).

(72) Inventors: **FISHER, Martin, J.**; San Francisco (US).  
**CARLSON, Lawrence, E.**; Boulder, CO (US). **TAR-  
BELL, Ben**; East Palo Alto, CA (US). **KAPLAN,**

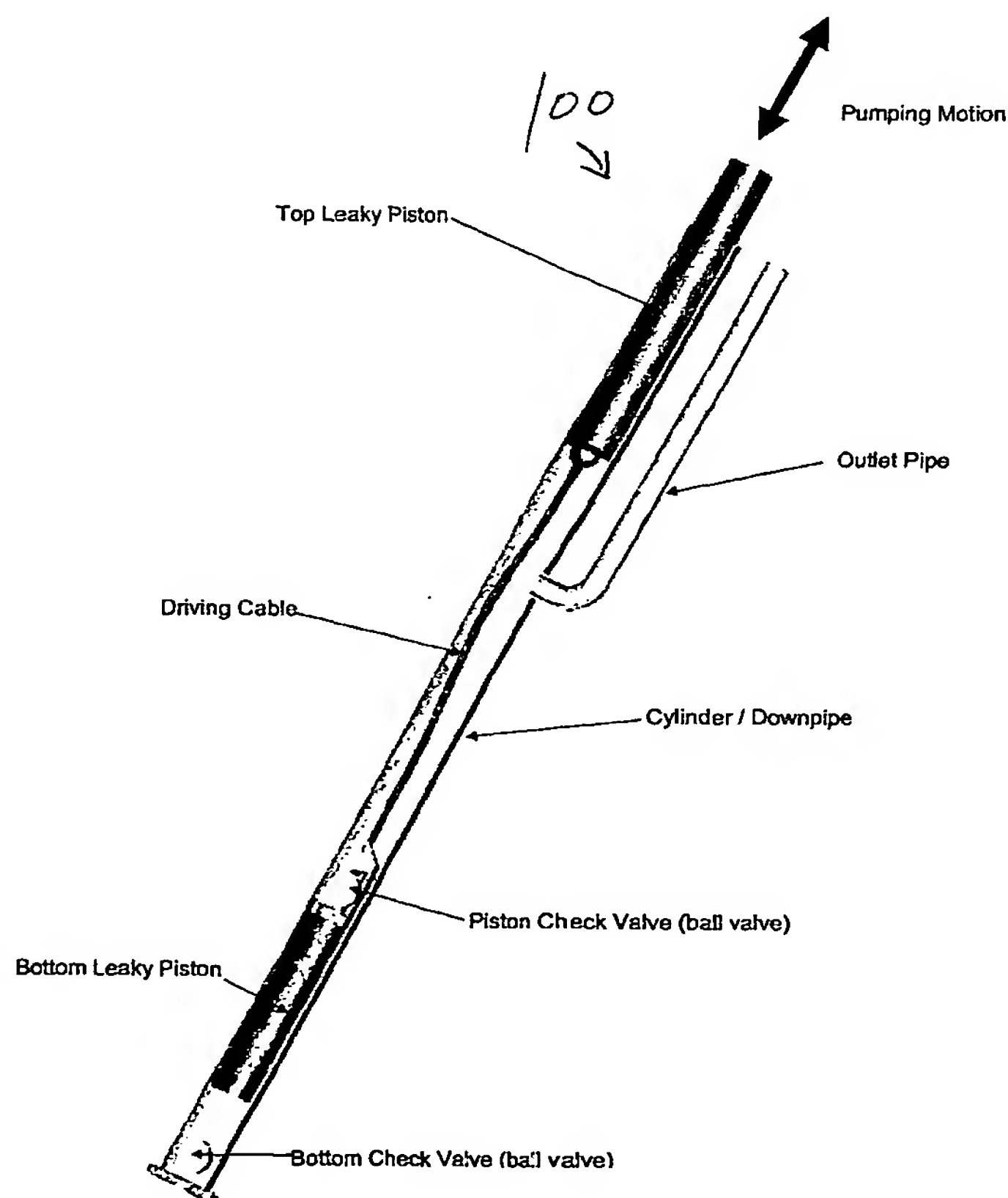
**Jonathan, I.**; Palo Alto, CA (US). **YOM-TOV, Opher,**  
**Doron**; San Francisco, CA (US). **ADLER, Ari, T.**; San  
Francisco, CA (US). **KURJAN, Christine, M.**; Mountain  
View, CA (US). **LISTER, Robert, Ian**; Doronfield,  
GB (GB). **BANERJEE, Shilajett**; Belmont, CA (US).  
**SWALEH, Mohammed**; Nairobi, Kenya (KE). **SPYBEY,**  
**Alan, C.**; P.O. Box 454 Village Market, Nairobi, Kenya  
00621 (KE). **MUSA, Abdilkadir, Mohammed**; Tanzania  
(KE).

(74) Agents: **SAMUEL, Richard, I.** et al.; Goodwin Procter  
LLP, 103 Eisenhower Parkway, Roseland, NJ 07068 (US).

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,  
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,  
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,

[Continued on next page]

(54) Title: DEEP WELL IRRIGATION PUMP



(57) Abstract: Provided herein are exemplary  
embodiments of an efficient pump apparatus. In one  
embodiment the pump apparatus comprises a piston  
assembly loosely disposed within a cylinder. The  
piston assembly includes a driving cable connecting  
a top leaky piston and a bottom leaky piston having a  
check valve connected thereto. The cylinder includes  
an outlet pipe at an upper portion thereof and a check  
valve located at a lower end of the cylinder. The  
pistons move in the cylinder at a velocity relative to  
the conduit such that as the pistons move along the  
cylinder they create a substantial tortuous leak path  
forming a hydrodynamic seal between the pistons and  
the cylinder.



PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*